THE REAL CHALLENGES IN THE MANUFACTURING SUPPLY CHAIN

BY

EDUARD PERICAS CLAVÉ

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Approved _____
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ABSTRACT

Supply chain professionals face very diverse challenges in their supply chains. These challenges vary across business industry, activity and department. The purpose of this qualitative research project was to explore what are the real challenges that a few manufacturing firms face in their daily activities, in different areas and departments. The project is based in six interviews made to supply chain professionals in six different manufacturing firms in the Chicago area. These interviews led to three main themes: supply chain challenges that these individuals are facing in their day-to-day activities, performance measurement of such activities and the concepts of flexibility and agility in their supply chains. The results show that the challenges predicted by the academics are very close to the ones mentioned by the interviewees, that these challenges vary across industry, department and business strategy, and that there is a different understanding of the concept of agility and flexibility among the different supply chains.

CHAPTER 1

INTRODUCTION

Before starting this project, I had heard about many tendencies that affect today's supply chains: the internationalization of businesses' activities, suppliers and consumers, the constantly increasing customer demand, with changing needs and wants, the omni-channel market and its retail issues and the development of new technologies.

After some investigation, my interest in the matter grew and decided to learn more about the topic. It is then when the idea of interviewing professionals from the manufacturing industry arose, with the objective of learning about the challenges of the industry by first-hand and with a possibility of giving the research a practical approach, contrasting the information learnt in these interviews with the academic research.

The project was originally designed to answer the following questions: What kind of challenges are the traditional manufacturing companies facing in their supply chains? Are these challenges affecting both large enterprises and small & medium enterprises? How do these firms measure their performance and their response to such problems? How agile is their response in front to these issues? There is also interest in discovering what features do firms value the most in their supply chains: cost-effectiveness, efficiency, agility, flexibility, etc.

Consequently, the project is divided in several sections. First, there is an analysis and collection of relevant academic research made in relation to manufacturing supply chain challenges. Then, the interview process is described, explaining the methodology used and questions made to the interviewees, followed by the results of such interviews, with its

subsequent analysis. At the end, there is a short section describing the performance measured by the different companies.

The review of the academic literature, the first section of the document, is based on reports and academic journals written by professionals in the supply chain field. In general, academics seem to agree on most of the challenges that companies are currently facing and that will probably face in the future.

As previously mentioned, the project seeks to have a professional perspective and in a realistic and practical approach, through interviews made to senior and high managers from different industries and departments. In total, six different companies and six different departments have been analyzed, trying to give the project an overview across a variety of departments and areas. The interviewees range from individuals at senior positions, as a Demand Planner or a Commodity Manager; to high-level managers, as a General Manager and a President. The departments analyzed and which are related to supply chain are: Planning, Logistics & Distribution, Finances, General Management, and Purchasing & Procurement.

As a result of these interviews, a general understanding of manufacturing supply chain challenges has been developed, differentiating these challenges by industries and departments, discerning the situations that different companies were facing. Moreover, the fact of connecting with people from such different firms and departments has made me understand how complex can supply chains be.

This project has many limitations in its scope. Considering that the body of the project is based in six interviews, there is a lot more that can be learnt from different companies, departments and individuals.

The project also seeks to satisfy personal interests and has a set of diverse motivations: to learn how to appropriately connect with high level managers in the manufacturing industry, to learn by myself about the challenges in different companies and contrast the personal experience and learning facts with the academic research, to grow a network of contacts in the supply chain field, amongst others.

CHAPTER 2

REVIEW OF THE ACADEMIC LITERATURE

2.1. Supply Chain Challenges

In the actual context of globalization, there is ample support for the claim that nearly every supply chain has been impacted by this tendency of globalization [4]. The internationalization of business activities and markets has brought new competitors to the market and the business landscape is constantly changing, bringing new challenges to modern businesses.

In such globalized environment, it is a huge challenge for companies to remain competitive, creating a responsive and cost-effective supply chain. To successfully fulfill the requirements of a consumer, offering a product at the right quantity, price, time and place, supply chains must be cost-efficient, responsive, efficient, flexible and agile [3].

The current literature on supply chain abounds with descriptions of challenges and issues that supply chains in manufacturing firms are currently facing. Three articles stand out for their depth and development of the description of these issues: “The Five Challenges of Today’s Global Supply Chains”, by Supply Chain Digest; “The biggest challenges supply chain leaders will crush on 2016”, by Canitz and “A literature review on the linkage between supply chain challenges and key success factors for small and medium size enterprises”, by Stonkuté. The following paragraphs describe these issues.

Per Canitz, supply chain challenges vary across industries, geographies and business strategies [1]. Even though he claims that it is nearly impossible to predict these challenges,

he considers the following as the most important ones: increased disruptions, mainly affected by today's supply chains which are increasingly more complex, volatile and unpredictable; supply chain cost reductions, stating that it will be more difficult to lower total costs with the rise in interest rates and a possible raise in fuel prices; increased customer service expectations due to a greater access to product and business information from the customer side; and demand unpredictability, which should led to more supply chains adopting software solutions to upgrade their planning capabilities.

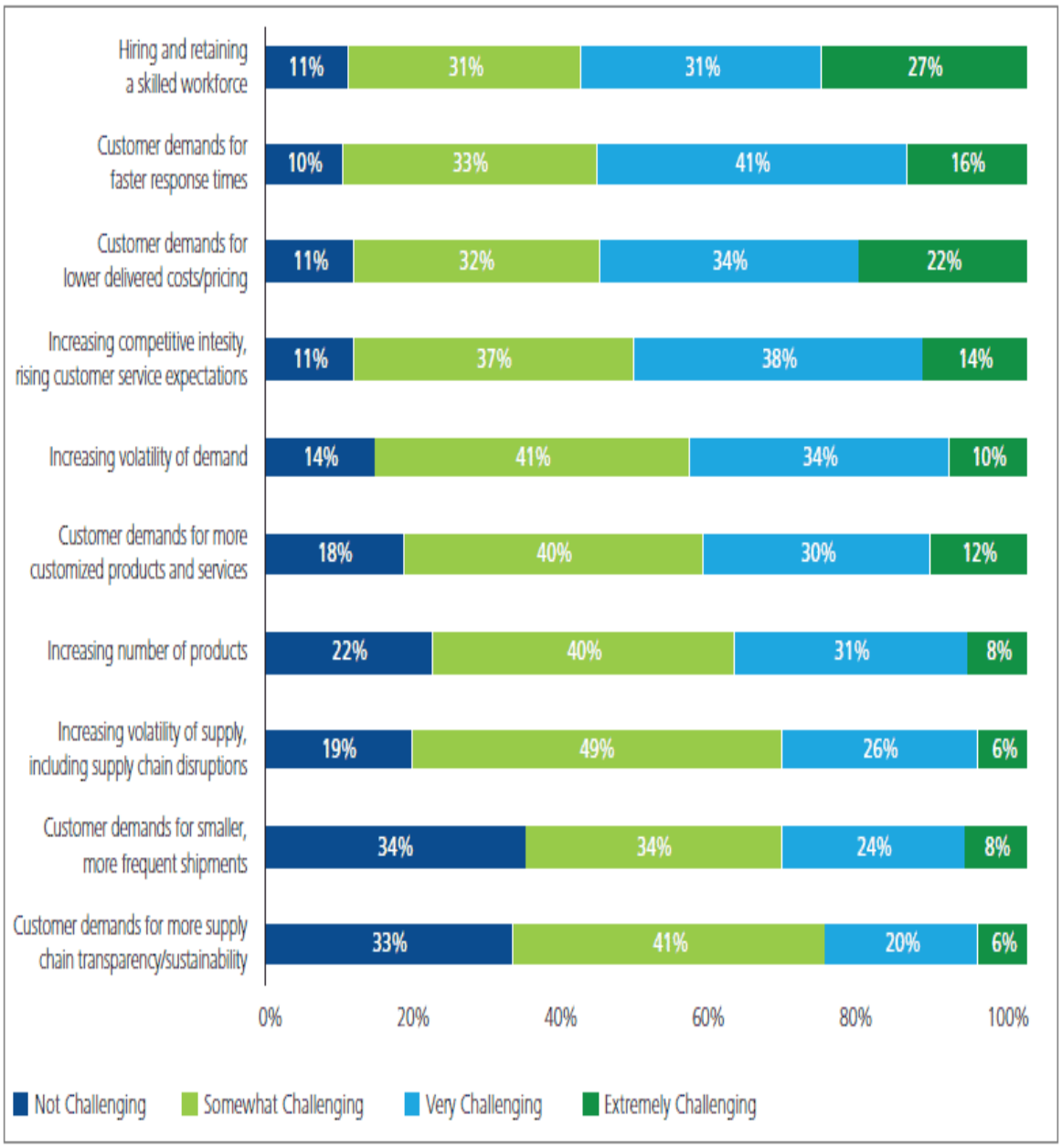

Figure 1. Graph of an annual study of the top supply chain challenges in 2016. Reprinted from Supply Chain Graphic of the Week: A New Look at Top Supply Chain Challenges, in *Supply Chain Digest*. Retrieved from http://www.scdigest.com/ontarget/16-05-20-1.php?cid=10728/. Copyright 2013 by Supply Chain Digest.

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In another article written by Supply Chain Digest, “The Five Challenges of Today’s Global Supply Chains”, which includes a survey led by the PRTM management consultant group that identified a set of key supply chain challenges (Figure 2), after interviewing supply chain executives around the world.

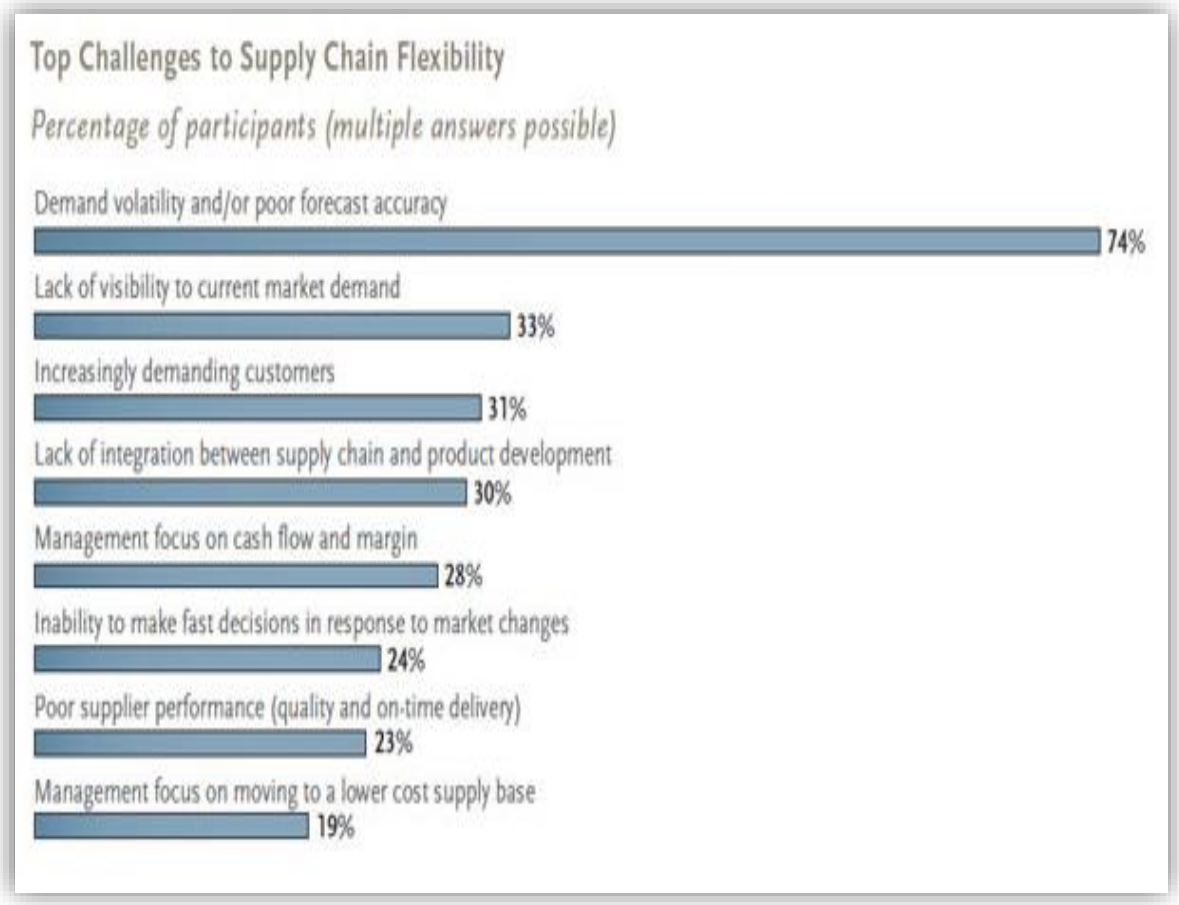

Figure 2. Graph of the top Challenges to Supply Chain Flexibility in a survey made to 350 supply chain executives. Reprinted from Supply Chain News: The Five Challenges of Today’s Global Supply Chains, in *Supply Chain Digest*. Retrieved from http://www.scdigest.com/ASSETS/ON_TARGET/10-08-12-3.php?cid=3649/. Copyright 2013 by Supply Chain Digest.

In the survey, the following challenges were described as the key factors for future supply chains: Supply Chain volatility and uncertainty, caused by the lower customer loyalty as a consequence of increasing market transparency and greater price sensitivity; an increased supply chain complexity due to globalization and international customers; the need to regionally tailor supply chains to adapt to customer requirements and competitors; lack of real integration within the supply chains, which is essential to respond effectively to the supply chain challenges; managing risk end-to-end, embracing all the parts and functions in the supply chain [8].

Stonkuté also made a literature research and analyzed the challenges in supply chain management. He states that the main challenges will be related to the need to cope with supply chain risks and disruptions, the leadership within the supply chain; the importance to manage the timely delivery of goods and services; the need to innovate by drawing on the capabilities of the supply chain; and the need to implement appropriate information exchange technologies to increase supply chain visibility [6].

All these challenges previously mentioned, and that come from different sources, are summarized in the following table (Table 1).

Table 1. Summary of Supply Chain Challenges from Academic Literature.

Author	Challenges
Henry Canitz	Increasing disruptions
	Supply Chain cost reductions

	Customer service expectation
	Demand unpredictability
SC Digest Editorial	Increasing volatility and uncertainty
	Increasing supply chain complexity
	Lack of real integration
	Managing risk end-to-end
Eglė Stonkuté	Disruptions
	Risks
	Supply chain visibility
	Leadership
	Timely delivery

2.2. Large enterprises and Small and Medium enterprises

However, globalization is not affecting every company in the same way. Though the globalization challenges might affect every company to some extent, every company has its particular challenges. As Canitz mentioned, it depends on the industry, geography and business strategy.

Reckliers stated that even Small and Medium sized Enterprises (SMEs) are forced see themselves in a global context, even if they don't have international activities like importing or exporting [5].

Stonkuté goes a little further and states that the challenges that medium and small-sized enterprises face in their supply chains are most of the times very different than the ones for large enterprises (LE). In his opinion, large companies mainly cope with the specific issues that arise from the globalization context while medium-sized companies mainly face their particular challenges and limitations and seek for their success factors in this globalization context, where large supply chains are becoming global supply chains [6].

He also describes small and medium enterprises to be known for their usual lack of resources, knowledge and money, in comparison with larger companies, and having a strong reliance on a small number of customers and the need for multi-skilled employees.

The term flexibility is also mentioned in his work, and it is considered to be one of the most important abilities that firms must have in order to be able to respond to disruption, changes and challenges in its industry. He says that, even though small and medium enterprises have the disadvantages previously mentioned, "SMEs are more flexible, have organic structure and centralized decision making process, shorter communication lines (because of low formalization of communication) and are closer to customers" [6].

In terms of supply chain management (SCM), he says that small and medium enterprises have different attributes and strategies compared to large enterprises. The first are rather focused on a smaller market niche, have a short-term perspective and have a

weak coordination among their whole system that leads to strategies as having a huge safety stock, protecting themselves from possible disruptions or sudden changes.

Moreover, small and medium enterprises are said to be less able to take advantage of the benefits of this management, and that their performance is very different when using supply chain management techniques [7].

Stonkuté also defined and described these supply chain of LE and SMEs, differentiating its main attributes (Figure 3). As a summary, large enterprises mainly see the supply chain as means to reduce its costs, by optimizing the different parts of the supply chain: the reduction of inventories to minimum levels, a correct planning of sourcing and negotiation and by offering a standardized product which allows them to make an economy of scale. Large enterprises are able to perform at such level thanks to the synchronization of materials, funds and information through the proper information technology programs [6].

On the other hand, small and medium enterprises tend to focus on particular market niches, offering a customized product to its customers and seeing the supply chain as a tool to earn profits in the short term. The usual lack of use of technology in the SMEs leads to different usual consequences as the use of safety stock and the fact of processing transactions in the old way.

Stonkuté made a thorough study of small and medium enterprises and analyzed its many strengths and disadvantages. He said that their performance is based on three main pillars: low bargaining power, low importance of innovations and lack of information technologies [6].

In his own words, “it seems that SMEs are still locked in their own performance limitations and coping with their own success can hardly support the success of the supply chain or, from other perspective, solving their own success problems SMEs can become a valuable and supportive partner in the pursuit of the success of the whole supply chain. In that case leadership in the supply chain, trust and collaboration among the supply chain partners could be the main success defining factors for SMEs in the supply chain” [6].

Attributes	Large enterprises	SMEs
Competitive priorities	Market dominance through sustaining large market share	Market niches through sustaining profitable market position
Supply chain view	A strategy to compete through reduction of system wide cost	Owner led myopic and short term view to earn the profit
Inventory management	Aims at reducing system wide inventory cost to improve overall supply chain competitiveness	Use of safety stock unavoidable in absence of coordinated purchasing function and supplier relationships
Key sourcing activities	Supplier scoring and assessment, supplier selection and contract negotiation, design collaboration, procurement, sourcing planning and analysis	Evaluates suppliers mainly on cost and quality criteria. Long term view of collaborative design and responsiveness to fluctuating demands is missing
Time frame and relationships	With and intention to reap the rewards of consistent quality, timely deliver, cost advantage, early design modifications, etc.	Becomes potential acquisition targets of larger enterprises when the supply chain works well
Supply chain flows	Synchronized material, information, money and ownership flows	Finds difficulty in managing material flow in case of disturbed money and information flows
Product offerings	Standardized to achieve economies of scale	Customized to cater the changing needs of buyers
External control structure	Decentralized, structured and highly specialized; multiple core competencies development	Centralized, semi-structures and moderately specialized; specific core competencies development
Internal control structure	Command and control towards their small suppliers and distributors; collaborate with more dominant suppliers and distributors	Either accept command and control by original equipment manufacturers or 1st tier suppliers or utilise their negotiation strengths; pursue collaboration with other SMEs
Coordination mechanisms	Well developed at inter and intra organizational level	Suffers even from internal coordination problems
Transaction processes	Systematic and computer based	*Ad hoc* and paper based
Use of information technologies and information	Part of business strategy	Still a buzz word

Figure 3. Attributes of the different size of enterprises. Reprinted from A Literature Review on the Linkage between Supply Chain Challenges and Key Success Factors for Small and Medium Size Enterprises, by E. Stonkuté, 2015, *Management of organizations: Systematic Research*, *74*, p. 129.

Among the strengths that SMEs present, there is the close customer contact and ability to maintain close customer relationships [5]. As key success factors we can find trust, strategy, waste reduction and team working, while other capabilities such as new technology, time to market and customer management are considered to be of medium importance (Table 2).

Table 2. Summary of a categorization of SMEs capabilities

Very important	Medium importance	Innovation
Trust	New technology	Supplier development
Strategy	Inventory reduction	e-Commerce
Waste reduction	Customer management	Benchmarking
Team working	Time to market	Employee development

Note. Adapted from "A Literature Review on the Linkage between Supply Chain Challenges and Key Success Factors for Small and Medium Size Enterprises" by E. Stonkuté, 2015, *Management of organizations: Systematic Research*, *74*, p. 131.

This author also links and relates supply chain challenges and the key success factors previously mentioned (Figure 4).

As a brief summary of the academic research analyzed, challenges in manufacturing supply chains mainly differ depending on the size of the company, being also divided into small and medium enterprises and large enterprises. SMEs' challenges are usually strongly

related to their particular situation and strategy, while LEs seem to face challenges which are related to internationalization and globalization.

Supply chain challenges	Key success factors for supply chains	Key success factors for SMEs	SMEs performance
Blurring organizational boundaries Collaboration Flexibility Innovativeness within the supply chain Leadership within the supply chain Managing communication within the supply chain Managing globalization Managing risk Managing sustainability Supply chain integration	Agility Collaboration Cross-functionality Culture of partners Customer communication Flexibility Goals of partners Information sharing Innovativeness Long-term perspective Performance of partners Senior management commitment and involvement Skill and knowledge integration Supply chain integration Transformational leadership Trust Visibility	Collaboration Customer relationship Information management Strategic partnership with suppliers Supply chain facilities Team working Top management support Trust	Ineffective sharing of information Lack of competencies and knowledge (in management) Lack of information technologies Lack of leadership competencies Lack of responsiveness Low bargaining power (compared to customers' bargaining power) Low importance of innovations Short-term perspective

Figure 4. Linkage of Supply Chain challenges and its key success factors. Reprinted from A Literature Review on the Linkage between Supply Chain Challenges and Key Success Factors for Small and Medium Size Enterprises, by E. Stonkuté, 2015, *Management of organizations: Systematic Research*, *74*, p. 132.

2.3. Flexibility and agility

As previously mentioned, flexibility and agility are very important success factors for firms, in order to be able to respond to external and internal changes, in a fast and smooth way.

Mr. CSCP has described each term to avoid confusions and have a standardized set of metric related to each attribute.

First, agility is "an attribute that describes the ability to respond to external influences; the ability to and speed of change". Examples of external influences would include non-forecastable increases or decreases in demand, suppliers or partners going out of business, natural disasters, acts of (cyber) terrorism, availability of financial resources (the economy) and labor issues [4].

Agility includes in its definition two different terms: flexibility and adaptability. The first refers to the time it takes to respond to a demand change, while adaptability is related to the amount of production change that an organization can achieve and sustain in a fix amount of time [4].

The term responsiveness is also distinguished as "an attribute that describes the speed at which tasks are performed". This attribute is said to address repeated speed of doing business. The metrics that are related to this attribute are cycle time metrics, such as Order Fulfillment Cycle Time.

In any case, Stonkuté already foresaw that flexibility is becoming a central issue for supply chains of small and medium enterprises. For him, firms need to be flexible in order to respond rapidly to changes, such as market volatility, the increase of customer

awareness, shorter lead times and shorter product cycles. In his research, he also found that companies are giving more importance on consistency, in quality and delivery, than in supplier price. This finding explained the increasing importance of time to market. Moreover, he stated that the companies that invested more time and gave more importance to supplier costs, many times resulted in a low product quality, long lead times and dissatisfied customers.

Fayezi, Zutshi and Oloughlin investigated, through an empirical study, how firms perceive and understand these terms previously mentioned (flexibility and agility). He confirms in his findings that "there is some ambiguity concerning the understanding of the terms agile and flexible" [2].

In his findings, agility was seen as "a strategic decision maker that allows to respond externally to changes". Agility was mainly related to three key words: speed of response, quick reaction and customer needs. Flexibility was defined in many of his interviews as an organization's "ability to change". The key words related to flexibility are: ability to change, new solutions and time and cost.

At the end of his work, they make the following propositions (Table 3):

Table 3. Summary of Fayezi, Zutshi and Oloughlin's propositions.

Propositions
P1. Agility is the ability of an organization to respond quickly to external uncertainties, whereas flexibility is the response to uncertainties by the means of change.

P2. Agility and flexibility are both proactive and reactive response mechanisms, contingent on the size of the company, the nature of the task and the type of product.

P3. Supplier agility is more important than customer agility to the SC agility as a whole.

P4. The perceived importance of supplier and customer flexibility to SC flexibility is dependent on the manufacturing environment of the organization.

Note. Adapted from "A Literature Review on the Linkage between Supply Chain Challenges and Key Success Factors for Small and Medium Size Enterprises" by S. Fayezi, A. Zutshi and A. Oloughlin, *International Journal of Operations & Production Management*, *35*(2), p. 246-281.

The research also led the authors to define supply chain agility and flexibility. Agility: a compilation of mindset, intelligence and process across SC organizations which enables organizations to respond quickly to the environmental uncertainties and changes in a reactive, proactive and, ultimately, predictive manner by relying on their relationship integration in order to fulfil end-customer requirements. Flexibility: The extent to which SC organizations can change economically in response to environmental uncertainties and changes in a reactive and proactive manner in order to adjust to customer needs.

CHAPTER 3

FOUNDATION OF THE STUDY

This project is based on several interviews made to professionals in the manufacturing industry, trying to give this project a varied insight of the challenges that this industry is facing, by interviewing companies from different manufacturing sectors.

The second phase of the project consists of several interviews made to professionals from diverse companies and supply chains, working at different levels and in different departments. The objective of the interviews is to get an overview of supply chain challenges from different industries and management levels (from Demand Planners, to Presidents, going through Managers). These interviews included in their vast majority visits to operation plants, while some others were performed through phone interviews.

A set of questions was designed and then asked to the interviewees.

3.1. Research question

The project aims to answer the following questions: What kind of challenges are companies facing in their supply chains? How do they measure their performance and their response to such problems? How agile is their response?.

3.2. Interview questions

To get the most of the interviews, its questions were designed as open-ended, giving liberty to the interviewees to give their most valuable insights.

"My research project is focused on Supply Chain Flexibility. What I am trying to figure out through this interview is what kind of challenges are firms facing in relation to this topic (p.eg. market changes, customer relationship, customer needs and requirements, quantities ordered) and what do you do to manage these challenges? Particularly, I would be interested in knowing how do you measure such performance. Do you use any set of metrics?". After this introduction, the following questions were asked:

1. What kind of challenges does your supply chain and department face?
2. Do you have any unexpected changes that require some modification in your supply chain or way of doing things?
3. How do you measure performance in your department? Do you use Balanced scorecards, dashboards or a framework like the SCOR Model?
4. What metrics define your department's performance? Who decides them?
5. Is any metric more relevant than others? Do you consider any metric is related to one of your firm's competitive advantage?
6. Would you say these metrics are aligned with your company's strategic goals?
7. Do you use benchmarking?

CHAPTER 4

MANUFACTURING SUPPLY CHAINS: CONTEXT

The first step of the interviewing phase was to define what type of supply chains were going to be analyzed: manufacturing or service provider businesses.

The decision was to analyze manufacturing companies, for two main reasons: on one side, because it usually involves a supply chain which is usually better defined, being easier to identify its areas; and on the other side, because there is a high diversity of manufacturing companies in the area were the project was developed.

4.1. Firms analyzed

Six manufacturing companies were interviewed on the first phase of the project. The group of companies was formed by two chocolate manufacturers, one business to business and one business to consumer; a radio manufacturer; a grill manufacturer; a rack manufacturer and a pharmaceutical business.

Among the companies that were interviewed, most of them belonged to different industries: the food manufacturing industry, the pharma industry, the electronics industry, the metal manufacturing industry. Shown below there is a description of the companies analyzed in this project:

- One of the world's largest manufacturer of high-quality chocolate and cocoa, with more than 10,000 employees operating in 30 different countries, and with

an annual revenue of USD 6.8 billion. As a business-to-business, the firm serves the entire food industry, from other business, to hotels, bakers and restaurants.

- A Chicago based chocolate manufacturing company, known for its fundraising products and personalized chocolate gifts, and which has raised over USD 4 billion for fundraising since its foundation. Its estimated annual revenue is of USD 220 million.
- A producer of gas, charcoal and electric outdoor grills. Its products are sold around the world and its estimated revenue is of USD 1.2 billion.
- A proprietary speaker manufacturer, for cars and televisions, with headquarters in Chicago and annual revenues estimated around USD 21 million.
- A steel rack manufacturing company, warehouse automation and management software, with an estimated annual revenue of USD 375 million and production centers in Europe and the Americas.
- A global pharmaceutical company, provider of products headquartered in Barcelona, with a revenue around USD 800 million.

4.2. Departments analyzed

To get an overview of the characteristics and challenges of the various parts of the supply chain, senior managers from different departments where interviewed. The departments analyzed are: Demand Planning, Logistics, Finances, Operations, Inventory Management, Purchasing and Procurement. All these departments take part in the supply chain of a company.

The following figure (Figure 5) illustrates the departments and companies that were analyzed in this project:

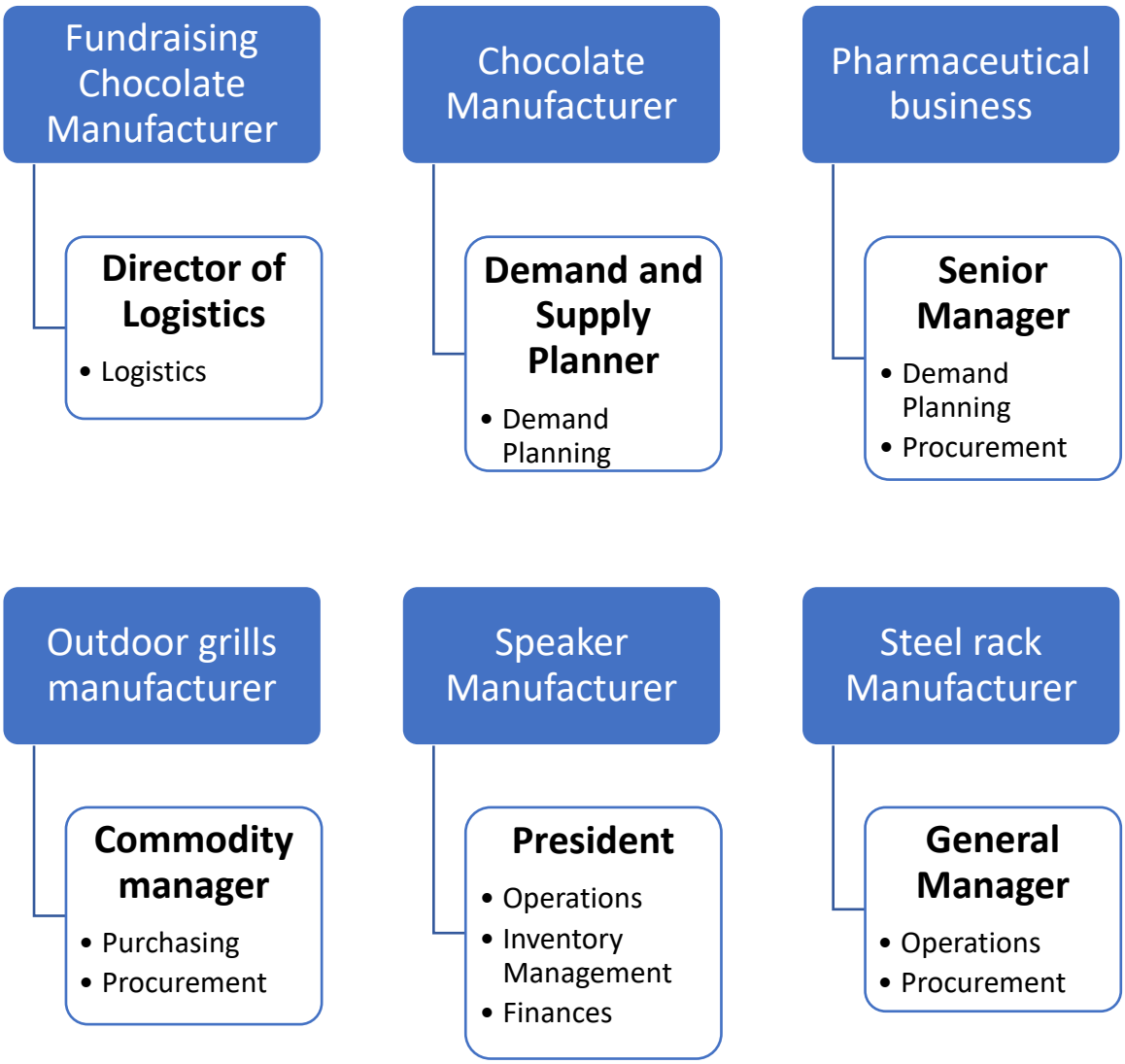

Figure 5. Departments and firms analyzed.

Most of the interviewees gave their insights and explained their experiences coming from many diverse parts of a supply chain (e.g. President at the speaker manufacturing firm

and General Manager at the steel rack manufacturing firm). These two interviews were particularly interesting, considering that the information amongst different departments and parts of the supply chain was given.

CHAPTER 5

MANUFACTURING SUPPLY CHAIN CHALLENGES

As mentioned in the previous chapter, six employees from six different companies were interviewed in order to analyze the challenges in the supply chain of these manufacturing firms.

This chapter is displayed in the following way: first, there is a description of each company's activities and current situation, with an explanation of their challenges; second, a contrast of information and its evaluation, determining if these challenges are related to the ones previously mentioned, in the Academic Literature chapter.

5.1. Description of the firm's current situation and challenges

A) The fundraising chocolate manufacturer

The first interviewee for this project was Todd P., Director of the Logistics department at the fundraising chocolate manufacturer.

As a fundraising chocolate manufacturing company, the firm's main purpose is to raise money for school students and associations, through the sales of their two main products: chocolate treats and chocolate bars, being the latter their largest business.

The company also seeks to give their customers an unforgettable experience, and thus the company considers essential to make accurate deliveries, in terms of time and of product mix, and to offer the option to their customers to customize their gifts at no extra

cost. Most of the times, customers order a great mix of products, with different types of chocolate bars and products.

In such context, the logistics department finds itself in a situation where delivering to its customers the right mix of products and at the right time is critical. Therefore, the department's main issue is considered to be related to the forecasting of demand planning (at a SKU level), in terms of distribution of orders to the customers, because it has a strong impact on the subsequent replenishment and distribution. Considering that the customer's orders usually include a mix of products, the department needs to have the proper product mix in its warehouses, ready to be shipped to its customers.

The department also considered very important the fact of being efficient in its transportation, and one of their assignments was to avoid the split of shipments as much as possible, that is to say, sending products to the same customer from different warehouses. Through shipment optimization, transportation costs are saved and on-time delivery are more likely to be successful.

B) The chocolate manufacturer

The interviewee at this B2B Chocolate Manufacturing company is a Demand and Supply Planner, in the Planning department. The interviewee described the company to be in a context of growth, with constantly increasing demand and sales. The company has offices around the world and in many countries the demand is increasing at a great pace. To keep up with such increasing demand, the company is building partnerships with other

chocolate manufacturing firms and acquiring underutilized assets, increasing its production capacity.

The planning department has the major role of balancing demand and supply, which are both rapidly changing. In this situation, the company must develop a quick adaptability and responsiveness to change. As a result of this rapidly changing environment, the planning department needs to be very accurate in its forecasting of demand, and being able to meet such demand by having a strong capacity planning team and Sales and Operations Planning (S&OP) function that coordinates all the different departments in a common plan and reaching a final consensus, having as an important objective to balance demand and supply.

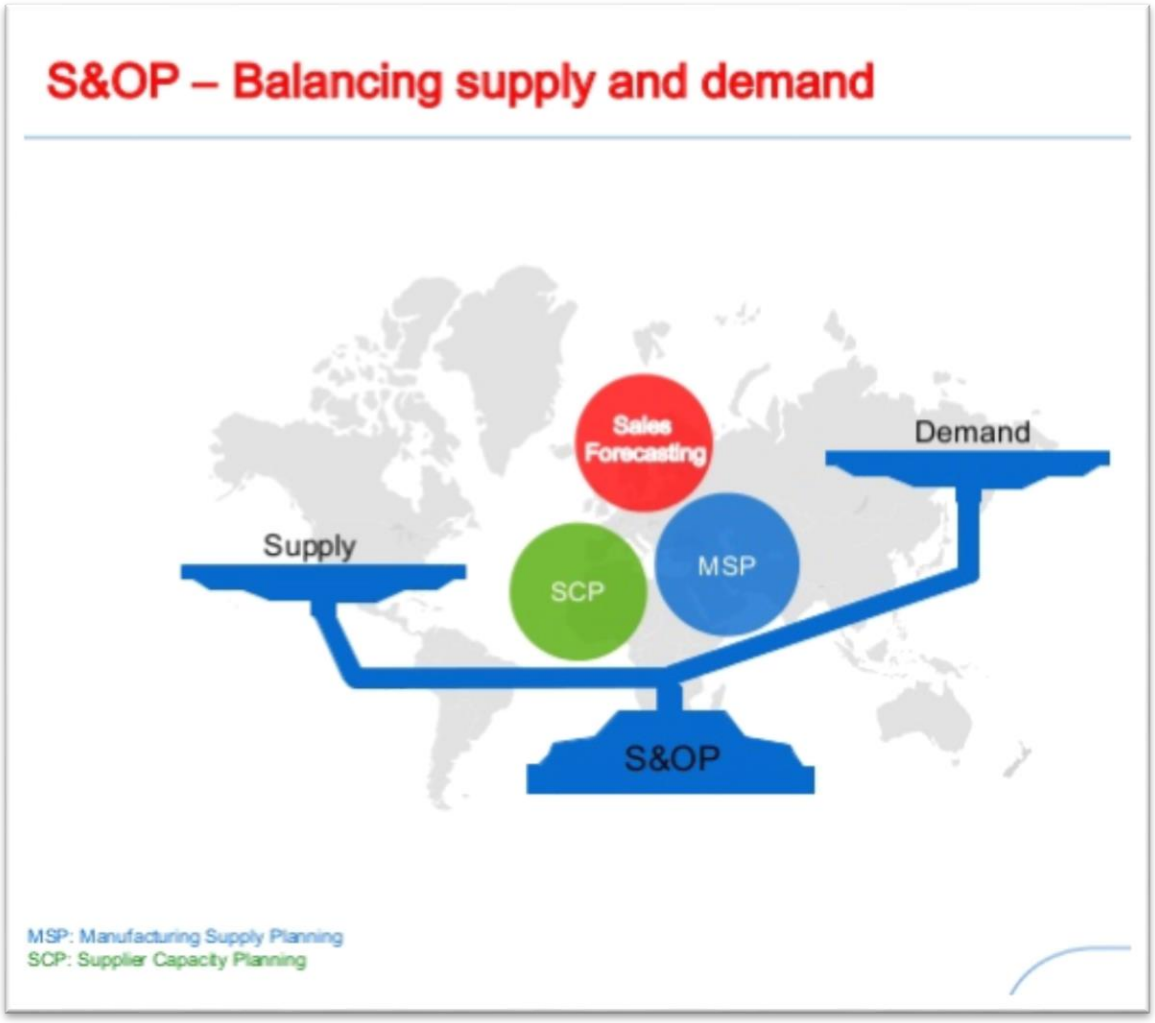

Figure 6. Sales and Operations Planning. Balancing Supply and Demand. Reprinted from Sales and Operations Planning (S&OP). Retrieved from https://www.slideshare.net/ELSCC/sales-operations-planning-sop-ram-nalawade/. Copyright by SFK. Reprinted with permission.

The Supply Chain Manager of the firm considered the Sales and Operations Planning process to be one of the most important issues or functions of the company. Particularly, adapting the S&OP processes from the main offices to subsidiaries in other countries and building an efficient and solid process. As a result of the great increase in

demand previously mentioned, the company is increasingly interested in having a highly effective S&OP process that can help balance demand and supply while effectively serving its customers in the Americas.

Another issue related to the S&OP process encompasses communication between departments, which is essential but can be sometimes tricky. It is very important to have a strong leadership team that cares about a true collaboration between departments.

C) The pharmaceutical business

The interview at the pharma business was especially interesting for its rich feedback and for its big differences with the rest of manufacturers, being a business and industry with very particular challenges and problems.

Pharmaceutical businesses are known for having strong restrictions and regulations in their activities, because of the nature of its products, and for having great profit margins usually which lead to a smaller interest in supply chain optimization, comparing to other businesses. The fact of having multiple quality and regulatory processes always imply very long lead times that makes pharmaceutical supply chains slow and with less reactiveness than traditional manufacturing firms. The pharma business was defined as a “not too agile” business.

In this particular company, the supply chain could be divided in two parts, in regards to its two main manufacturing processes. On one side, the company has subsidiaries around the globe, where the manufacturing process has a make-to-order approach. In this case,

stocks are sized for each subsidiary, based on the existing provisions and the existing safety stock levels.

On the other side, the pharma business also maintains a partner relationship with other businesses, usually in countries where the firm is not present, and these partners deliver for them the pharma products in the countries where the firm is not able to sell its products. In this situation, the manufacturing has a make-to-order approach, getting the orders to supply in 3-month time, allowing time to go through all the manufacturing process.

But challenges don't just vary across manufacturing processes, they also vary depending on the type of product that the firm manufactures. The majority of pharma businesses provide products that are necessary, vital and essential for the population, such as medicines that help cure or palliate lung and heart diseases. These type of products are considered to be critical and must be delivered on time and in a perfect condition. Therefore, the pharma business prioritizes to deliver these products, providing a great service, and leaving in the background the optimization of its supply chain costs. Thus prioritizing customer service over supply chain optimization.

The type of product also conditions the type of relationship that is maintained with a supplier. Suppliers of active principles, in contrast with suppliers of non-active principles, must obey more restrictive requirements and regulations. For these suppliers that provide active principles, the firm prefers to have a strong and long term relationship, trying to avoid the situation of changing suppliers as much as possible, which would lead to an situation which would consume lot of time and effort, since it takes a very long time to find a firm that meets the business' requirements and the government regulatory processes.

D) The speaker manufacturer

The President of the firm gave an overview of the challenges that the company is currently facing from a management point of view, describing challenges that happened in different departments and functional areas of the company.

From the supplier perspective, the speaker manufacturer has two main kinds of vendors: American suppliers, which usually have 2-6 weeks of delivery lead time and Asian suppliers, which have around 120 days (4 months) of lead time. The company currently has a relationship with an Asian supplier that has been ongoing for more than 35 years, and hasn't changed since then. Consequently, one of the company's main challenge is to find qualified vendors in both America and Asia, that can meet the desired requirements and lead times.

Another big challenge involves inventory management. Considering the suppliers' lead times, the firm usually keeps a 6-month inventory, minimizing any possible supplier risk, and thus having a 6/8-week safety stock that covers them for that time, keeping its operations going and being able to deliver its products in 24-hour time, which is a promise that the firm makes to its customers. Plus, inventory is processed in the old-school way, by hand, not using any computer program.

On the financials side, in the accounts payable department, the company has the opportunity to get a discount rate by paying its dues on time, which even though this rate is around 1%, it involves a relevant discount considering that the purchases can be of millions of dollars. This challenge is particularly interesting because this money saved will get no deductions for taxes and will be directly considered as a benefit. Therefore, the

company needs to be able to keep some money in the bank, to be ready to pay its purchases on time.

E) The steel rack manufacturer

The General Manager of the firm, Jordi B., gave insights of the challenges in the rack manufacturing business.

The company, originally from Spain, has multiple subsidiaries around the globe and operates in the United States. Their racks are unique in their design and are highly desirable for its quality-price relation. By offering a unique product with a very good quality -and which not many other rack manufacturers in the region produce-, the company has built a strong position in the market.

Being in such position, the company has a strong influence over its suppliers. One of the firm's objectives is to minimize suppliers costs by using their leverage power. Suppliers can try to negotiate prices with them, but if the rack manufacturing firm might have the last word in such negotiation and in case of big disagreement they would just find another supplier, since there is a huge amount of aluminum and iron local suppliers in the area.

F) The outdoor grills manufacturer

The interviewee at this firm was the Commodity Manager at the Procurement department, who was also in charge of the Supplier Relationship Management.

Two major challenges were distinguished to affect the Procurement department of the company, and both were directly related to suppliers and relationship management.

First, the greatest challenge was considered to be the fact of maintaining a long-term relationship with their suppliers. Considering that the final product -a grill- needs different parts to be assembled, many suppliers will be needed, and usually these suppliers will be very different, as a consequence of the different products and their nature. For some commodities, like the grill engine, there are just a few suppliers that can provide such commodity.

With these kind of suppliers it is necessary to maintain a long-term and successful relationship, to keep the business running and be able to get the best purchasing terms and deals. On the other side, there are items which can be purchased to a greater amount of suppliers. In this situation it is also interesting to build a long-term relationship with a supplier but the priority of the firm would be to get a good deal and fair prices for their supplies.

Second, the fact of switching sources of supply, whenever it happened. This process of switching supplier usually takes a long time, from one to one and a half year, and such process must be planned a long time in advance, because it is necessary to choose the right supplier after collecting samples and trying the components from the different potential suppliers.

Moreover, some components have particular regulations due to its nature, like most of the gas parts, which must be approved by government laws. This process with these kind of suppliers usually require a greater time to be able to find an appropriate candidate.

5.2. Summary of Manufacturing Supply Chain Challenges

The following graphic summarizes the results of the interviews, listing the challenges that were mentioned by the six interviewees, and which are outlined in the following illustration (Figure 8).

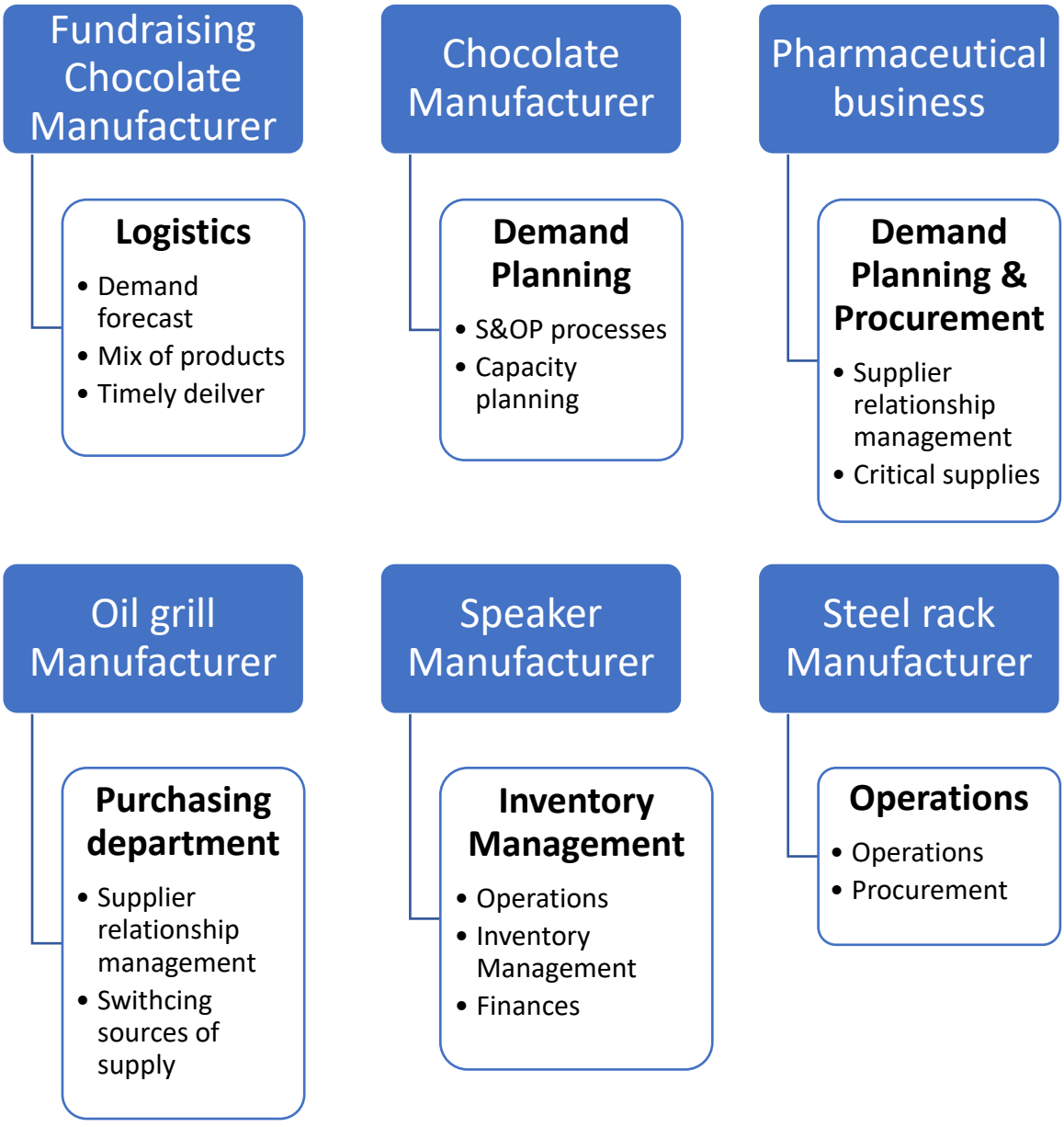

Figure 7. Summary of Manufacturing Supply Chain Challenges.

As it can be deducted from the graphic, many challenges mentioned by the interviewees are strongly related to globalization and international activities. This can be seen in issues such as supplier relationship management and the Sales and Operations Planning processes that are linked between subsidiaries of one of the firms analyzed, in different countries. Uncertainty and volatility also seems to be present in some of the challenges as the ones related to Demand forecasting.

CHAPTER 6

ANALYSIS OF THE SUPPLY CHAIN CHALLENGES

After carefully analyzing the challenges mentioned in the interviews, is has been observed that these challenges are very similar to the ones predicted by the Academics. In fact, many of the challenges listed by the professionals from the companies that were interviewed and analyzed were directly related to the ones mentioned by the Academics in their researches.

Before going into detail, it is important to understand that the academics, in their studies, they have made an overview of the supply chain challenges that might affect the majority of the supply chains, not specifying nor giving much details about what types of companies might be affected by such tendencies, and describing them in a "generalized" approach. On the contrary, the interviews made to supply chain professionals are based on a few particular departments of six different companies, giving an idea of what are the real challenges seen in the manufacturing industry, but only in a few companies and from a few different departments and industries.

One of the objectives of the project is to see if these challenges mentioned by the professionals from the companies analyzed are related or mentioned by the academics in their studies.

The following table relates and summarizes the challenges that were mentioned by the academics and relates it with the real challenges that the interviewees mentioned about their departments and supply chains, comparing these two sources of information.

Table 4. Comparison of Supply Chain Challenges from Academic Literature and the results from the Project Interviews.

Literature challenges	Challenges from interviews
Demand unpredictability	Logistics department at the fundraising firm
Increasing volatility and uncertainty	Demand Forecasting at the chocolate manufacturer
Leadership	Management at the speaker manufacturer
Increasing supply chain complexity	Management at the pharmaceutical business
Timely delivery	Logistics department at the fundraising firm

As Canitz mentioned, challenges in the supply chain depend on the type of industry, geographical situation and business strategy [1]. In this project, the companies interviewed are all located in the same geographical area, thus the geographical component hasn't been analyzed.

In terms of industry, it has been observed that challenges vary in great measure across business activity and industry. As previously seen, pharmaceutical businesses need to cope with issues that uniquely belong to their industry, such as their quality and regulatory processes, which define the businesses challenges to a great extent. Many other firms are also influenced by regulations, but usually in lesser extent. For example, the grill manufacturing company, which also needs to cope with regulatory issues related to some

of its grill components. These issues influence in great measure the business challenges, such as the supplier relationship management, which is one of the business biggest challenges.

Another observation arising from the results of the interviews is that globalization has had an impact, directly or indirectly, and on some extent, on every supply chain. Many of the challenges previously described are related to supplier relationship management, usually involving international firms from different countries and geographies.

For example, the electronics manufacturer maintains business relationships with suppliers from North America and from Asia. The firm has some problems dealing with the latter suppliers, since their lead times are a lot bigger than the ones offered by local suppliers and thus, he speaker manufacturing firm must plan in advance and keep a great safety stock for a relatively long time. Moreover, they have kept a relationship with one of the Asian suppliers for over 30 years, which is considered to be an important challenge for the firm.

As it is mentioned in chapter two, Review of Academic Literature, Large Enterprises and Small and Medium Enterprises might be affected by globalization in different ways and thus, might also have different challenges.

Among the six firms analyzed, there are two firms that in terms of revenue and number on employees, can be considered SMEs: the speaker manufacturer (21 million) and the fundraising firm (220 millions). These two firms have many characteristics that are in common with the attributes of the Small and Medium Enterprises summarized by Stonkuté.

The following table resumes the attributes that Stonkuté mentioned and that were also observed in the firms interviewed.

Table 5. SMEs attributes from Academic Literature present in the firms analyzed

Stonkuté's SMEs attributes	Firm's analyzed
Use of safety stock unavoidable in absence of coordinated purchasing function and supplier relationships	Yes. The electronics manufacturer keeps a 6/8 week safety stock to cover itself from unpredictable issues.
Evaluates suppliers mainly on cost and quality. Long term view of collaborative design is missing	Yes. One firm has Asian suppliers that offer supplies at very low prices. Although their relationship is old, it could be more collaborative.
Transaction processes are *ad hoc* and paper based	Yes. One of the firms handwrites many of its transactions and uses calculators to make its calculations.
Use of information technology is still a buzz world	Yes. Most of the processes in one of the firms are done manually and there is a lack of technology.

Finds difficulty in managing material flow in case of disturbed money and information flows	Yes. One of the firms is very sensitive to lack of information and funds, which is necessary for them to plan and make some necessary investments.

In addition, there are some other characteristics or attributes also mentioned by Stonkuté that were also observed in these SMEs

- More flexible supply chains: these two firms have a well-defined and small management hierarchy that makes the decision-making process a lot shorter, making their supply chains fast and responsive.
- Particular market niches: the electronics manufacturer, had been working in the Chicago area for decades, growing a small but regular group of customers.

In terms of capabilities, and in relation to the summary table of SMEs capabilities (Table 2), it was observed that these aptitudes described by Stonkuté were very close to what was observed in the firms studied. On one side, strategy and team working were mentioned in the interviews as pillars of their business, while technology and innovation was considered to be a secondary objective. In one case, a firm considered time to market to be a very important capability, while Stonkuté defines it as a medium importance capability, and that is because the firm considered time to market to take part of its strategy and was a promise made to customers that always needed to be maintained.

CHAPTER 7

FLEXIBILITY IN THE MANUFACTURING SUPPLY CHAIN

In today's fast-paced and uncertain changing society, where customers, clients and environment are constantly changing, supply chains are obliged to aggressively compete between themselves. To excel and to have the best supply chain, one of the most important aspects to consider is flexibility.

However, these terms are usually misunderstood or confused, or used in wrong contexts. Companies seem to differ in their concept of Supply Chain flexibility [2]. In the paper named "How Australian manufacturing firms perceive and understand the concepts of agility and flexibility in the supply chain", it is said in the abstract that "the findings confirmed that there is some ambiguity concerning the understanding of the terms agile and flexible, both within and between organizations".

As previously mentioned, flexibility is usually confused with other terms such as responsiveness and agility. Through these interviews, there is an interest in seeing what do firms understand as supply chain flexibility and agility, and then to compare these answers to the descriptions made by the academics.

To normalize and standardize the definition of these terms, Mr. CSCP makes a clear distinction and definition of them. The concept of Supply Chain Agility is defined as the ability to respond to marketplace changes, while flexibility is a metric included in this concept.

Key words	Interviewees	Sample references
(a) Agility		
Speed of response	A, D, F, I	(Prater *et al.*, 2001; Swafford *et al.*, 2008)
React/adapt quickly	A, C, E, F, G, H	(Dimitropoulos, 2009)
Lead-time	G	–
Planning	C, D	(van Hoek *et al.*, 2001; van Hoek, 2001)
Systems and processes	C, D, G	(Swafford *et al.*, 2006b)
Thinking and understanding	C, D, H	(Zhang and Sharifi, 2000)
Intelligence and skill	C, G	(Overby *et al.*, 2006)
Mindset and mentality	D, G	(Christopher, 2000)
Awareness of change	G, I	(Li *et al.*, 2009; Sambamurthy *et al.*, 2003)
Preparedness	G	–
Lean processes	A, G	(Christopher and Towill, 2001; Power *et al.*, 2001)
Learning	G	–
Openness and willingness	F, G	(McCann *et al.*, 2009)
Know-how and experience	D	–
Top view	C	–
Forward looking	A, I	(Sarkis, 2001)
Grab opportunities	C, F	(McCann *et al.*, 2009; Yusuf *et al.*, 1999)
Customer needs	A, D, E, F, G	(Goldman *et al.*, 1995; Sharifi and Zhang, 1999)
Supplier requirements	A	–
No/less disruption	A, G	(Braunscheidel and Suresh, 2009)
People	D, G	(Gunasekaran, 1998; Power *et al.*, 2001)
Business maturity	A	–
(b) Flexibility		
Ability to change	A, B, D, E, H, I	(Upton, 1995; Wallace and Choi, 2011)
How much/ability to respond	A, C	(Swafford *et al.*, 2006b)
Adjust to the needs	C, I	(Nagarur, 1992)
New solutions/different ideas	B, C, H	(Slack, 1987)
Time and cost	D, E, H	(Slack, 1983; Zhang *et al.*, 2003)
Inventory	D	–
Labour	G	–
Capacity	E	–
Output	E	–
Implementation	G	–
Set-up	A	–
Innovation	A, F	(Camisón and López, 2010; Martínez-Sánchez *et al.*, 2009)
Sustainability	A	–
Technology	A, B	(Sethi and Sethi, 1990)
Communication	B, C, D	(Corrêa and Gianesi, 1994)
Event	C	–
Dynamic	B	–
Systematic approach	B	–
Customer and market monitoring	B, H	(Cox, 1989)
Integrity and honesty	B	–
Structure	I	–
Improvement	F	–

Figure 8. Key words related to the interviewee's perception, in a research about supply chain agility and flexibility. Reprinted from How Australian manufacturing firms perceive and understand the concepts of agility and flexibility in the supply chain, by S. Fayezi, A. Zutshi and A. O'Loughlin, 2015, *35*(2), p. 256. Copyright by Emerald Group Publishing Limited.

Mr. CSCP also described these terms of agility and flexibility to help differentiate them, adding terms such as responsiveness and adaptability. First, the term of responsiveness is defined, which measures the time to fulfill demand. On the other hand, agility measures the ability to respond to market changes. But this term, agility, includes many different concepts inside of it. It is through this term that APICS differentiates flexibility and adaptability, defining flexibility as a measure in days to respond to a demand change and the latter, adaptability, as a measure in quantity of production change in a fixed time [4].

In the interviews, two companies gave feedback and insights about supply chain flexibility, explaining how they understood these terms it in their departments.

On one side, the individual at the procurement department in the grill manufacturing company didn't think there was an exact definition for flexibility. In his opinion, there are many shared principles, like risk management, that are used and which are related to these terms. In his specific department, his team tries to be flexible and agile by having multiple suppliers when possible and by shortening lead times.

Although he considered their supply chain to be less flexible than most supply chains, flexibility is still considered to be important. In his words, "for technical components like gas valves or gas regulators, we often only have one or two sources, and rely heavily on our supplier's engineering input and quality control. There's a mindset than on performance and safety items, we'd rather create a long term partnership with the best in the industry, rather than chase the lowest price and frequently turn over suppliers. We tend to have more flexibility on less technical parts".

In terms of metrics, he wouldn't say that their metrics directly measured flexibility, but some metrics with Quality (DPPM) and On Time Delivery (% On Time) are impacted by it. For instance, if a certain supplier has a quality issue on a part, risk can be mitigated by purchasing from an alternate source while this supplier implements a corrective action.

On the other side, the individual at the pharmaceutical business, in the demand planning department, defined supply chain flexibility as a reaction to sudden changes in demand that required a quick reaction, avoiding stock out situations.

He defined the pharmaceutical industry and its business to have "not to agile supply chains". In most cases, there are intense quality and regulatory processes, and the standard lead times tend to be very long. The production phase sometimes takes longer than two months.

The pharma business outsources the production of some of the medicines, whenever this product requires some technology or "know-how" that is unknown by the firm, for products that are considered to be non-strategic, and for small volumes of production, which are not worth producing in the company. When this outsourcing partner needs to be changed, two whole years are needed to validate such partner, and even more time to start collaborating..

As previously mentioned in this document, the pharma business can be divided in its production activities in relation to its production approach: make-to-stock and make-to-order. In terms of flexibility and agility, these two approaches were very different. On one side, the make-to-stock approach is more reactive, being majorly related to the firms subsidiaries which share information with the firm and allow quick reaction. On the other

side, the make-to-stock supply chain implied a longer supply chain, since partners were also included, and had a lot longer lead times, making this supply chain slow and not agile.

However, flexibility and agility was also considered to be very relevant for the pharmaceutical business. In first place, because there are some critical products that can be essential for the population, such as products for lung diseases. The production of these products need to be carefully planned, and it is usual to keep a large amount of stocks. Moreover, there are some extreme situations in which there is an unpredicted demand for this product that requires a quick reaction from the business. In this situation, the company must be very quick in finding a solution, satisfying the customers' needs in first place, and avoid possible government fines.

In terms of metrics related to supply chain agility and flexibility, the company prioritizes the ones that are directly related to the customers' service. One of these metrics is named stock out report, which includes the delays in delivery orders, and which measures the degree of stock out (the company gives different relevance to the different parts in the supply chain. E.g. It is more critical a stock out in a pharmacy, closer to the customer, than in a wholesaler).

CHAPTER 8

PERFORMANCE MEASUREMENT

Apart from the challenges that the firms face and their understanding of the terms of flexibility and agility, it is also interesting to analyze how these firms measure their supply chain performance, and if these metrics are related to the challenges that they consider in their supply chains.

The different metrics from five firms are described below, enumerating the different companies and then the metrics that they used in their departments.

1. The supply chain professional at the fundraising firm mentioned the following metrics used in their department:
    a) The first and most important metric is customer on-time delivery, getting shipments on time, whenever the order is scheduled to arrive.
    b) Measure rescheduling notices logged in in the system. The SAP module has a function – helped by the zip code of delivery – that indicates what warehouse should be the one that "delivers" the product. Sometimes, when there is not enough of one product in a warehouse (usually the order is a mix of products), and when this happens an automatic alert is created, which is called rescheduling mode (alert).
    c) Split shipments. The shipments have to be occasionally split –some items have to be sent from different warehouses. But customers don't want split orders, they want to get everything at once, and therefore the logistics

department keeps track of the number of split shipments made, trying to minimize this number and send all from only one warehouse.

These metrics are strongly related to the challenges that the professional mentioned in the interview: their struggle in what product mix they should do, and how to properly distribute the products to the customers.

2. At the chocolate manufacturer, in the Demand and Supply Planning department, the
    a) Forecast accuracy was considered to be the most important metric, because as it has been previously explained, and due to the constant growth of the firm, there is a constantly increasing number of demand which makes the firm to be constantly changing and adapting to this changes of demand, which is very uncertain and volatile.
    b) Two other metrics used are “weeks covered of coverage” and “stock on hand”, related to inventory management.
3. The electronics manufacturer has a daily handmade dashboard, called “Service Level Report”, that contains information about the orders received from their customers and the effectivity of the firm in their shipments. The firm makes a promise to its customers to deliver its products in less than 24 hours, and therefore the firm keeps constant track of this metric and tries to deliver always on time.

Table 6. Example of a Service Level Report

	Today	Month to date	Percentage
Total Orders Received	29	461	
Stock Orders Received	6	160	
Total Orders Shipped Within 24 hours	417	432	96.5%
Total Orders Shipped same day MTD	3	119	26%

4. At the procurement and purchasing department at the grill manufacturing firm, there are two main metrics used:
    a) Year-over-year save costing, where the difference of costs in a product purchase in different years is compared, to see if they are improving. This is done on the same month so seasonality is considered in the comparison. Plus, market changes are also captured.
    b) Supplier quality, measured in defects in parts per million, as well as time delivery.

The firm always tries to get the best products at the best price, and keeps track of the quality and services of their suppliers.

5. At the pharmaceutical business, in the planning department, there were two main metrics:

a) The department prepares a stock out report, which contains the number and condition of delays in delivery of commands, measuring also the gravity of the stock out (it is considered a lot worse having a stock out in the supply chain areas which are closer to the customer, such as pharmacies and hospitals, rather than having them in the wholesaler side).

In general, all the metrics were related with the challenges that the professionals mentioned in the interviews: the pharmaceutical business found essential to make deliveries on time, and their metrics are closely related to that; the grill manufacturer considers a main challenge their supplier relationship management and their metrics are also based on their supplier's performance; the chocolate manufacturer and its planning department is keeping track of its forecasting accuracy, etc.

CHAPTER 9

SUMMARY AND CONCLUSIONS

The feedback and the challenges given by the professionals of the six companies analyzed are strongly related to the ones mentioned by the academics in their reports, and papers. Some of the academics made a prediction a couple years ago about the challenges that supply chains would face in this decade, and most of these predictions were correct: supply chains are facing issues related to demand volatility and uncertainty, traduced in demand unpredictability, as seen in the planning department at the chocolate manufacturing firm; an increasing relevance of customer service, seen in other challenges like timely delivery, which two firms analyzed considered essential; increasing supply chain complexity, like the pharmaceutical business and its division of its supply chain, with two different manufacturing approaches: make-to-stock and make-to-order; and lack of real integration, seen in one of the chocolate manufacturer issues, which involved integration of sales and operations planning functions in the different subsidiaries around the world.

As some of the academics defend, many challenges that the supply chains of the companies interviewed were related to the business' industry and strategic situation. Industries like the pharmaceutical or manufacturers of inflammable products must follow strict rules and requirements that have a strong influence in its supply chains and way of doing things, most of the times adding complexity to the manufacturing process and the supply chain.

For the rest of the companies, the supply chain challenges are very similar to the general challenges that supply chains were predicted to face, by the academics. Usual challenges include relationship with partners, usually supplier relationship management, the increasing volatility and uncertainty in the demand side which ads complexity to some functions like demand forecasting and processes like the Sales and Operations Planning function.

Many of the challenges were also related to the globalization effect, involving international parties and activities across the globe, like the integration of the Sales and Operations Planning in the international subsidiaries of the chocolate manufacturing company.

Although this project makes a comparison between the Academic Literature and the real challenges that some companies face, it also had some other main objectives that were related to networking and learning. One of the project's intention was to gain a professional perspective of the issues and problems that real firms face in their daily activities, and also was getting in contact with many different professionals from the supply chain and learning from their insights and perspectives, building a network and having a great learning experience in the way.

The project, which was originally intended to be based on supply chain challenges, also talks about flexibility and agility, because it was a term that was incurred many times in the different interviews and seen as a very relevant topic to the interviewees. Moreover, after the first two interviews, the concept of supply chain flexibility and agility seemed to have different interpretations.

It was seen that there are big differences in the understanding of these same concepts across the different companies and departments, mainly depending on the company's industry and activities.

As an important characteristic for many almost all the supply chains in today's market and business environment, flexibility and agility are necessary abilities that such firms must possess, and all the interviewees agreed in that.

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